Before the
**FEDERAL COMMUNICATIONS COMMISSION**
Washington, DC 20554

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| In the Matter of | ) | |
| | ) | |
| Updates to Part 2 and Part 25 Concerning | ) | IB Docket No. 16-408 |
| Non-Geostationary, Fixed-Satellite | ) | |
| Service Systems and Related Matters | ) | |

# REPLY COMMENTS OF ONEWEB


Marc Dupuis
Policy Director
WorldVu Satellites Limited
1400 Key Boulevard, Suite A1
Arlington, VA 22209

Brian Weimer
Douglas Svor
Ashley Yeager
Sheppard Mullin Richter & Hampton LLP
2099 Pennsylvania Ave NW, Suite 100
Washington, DC 20006
(202) 747-1930


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## SUMMARY

The NPRM initiating this proceeding explicitly acknowledges the transformative connectivity services NGSO FSS systems are poised to provide in the coming years. In its comments, OneWeb strongly supported the Commission's efforts to modernize and streamline rules impacting NGSO FSS systems and to create a regulatory environment that encourages the rapid deployment of innovative, satellite-based services. The record developed in this proceeding reflects a broad consensus that updates to the Part 25 rules are warranted. OneWeb believes the Commission should expeditiously adopt the proposals set forth herein in order to facilitate the rapid deployment of these services. Specifically, OneWeb respectfully requests the Commission to:

- **Adopt the existing EPFD limits in Article 22 of the ITU's Radio Regulations.** For the portions of the Ka-band authorized for NGSO FSS operations, there is overwhelming support in the record for adopting the EPFD limits contained in Article 22 of the ITU's Radio Regulations. The existing Article 22 EPFD limits are adequate to fully protect GSO operations and the Commission should dismiss any suggestions to the contrary. When consolidating the EPFD limits for the Ku- and Ka-bands into a single rule section, the Commission should also streamline the required EPFD compliance showing by removing unnecessarily burdensome rules, such as the 90-day pre-service compliance showing for operational EPFD limits. Similarly, the Commission should not burden nascent NGSO FSS systems by adopting earth station e.i.r.p. limits.

- **Determine that the existing PFD limits adequately protect terrestrial operators.** There is no evidence indicating the PFD limits contained in Section 25.208(e) of the Commission's rules will not sufficiently protect terrestrial operations in bands authorized for NGSO FSS systems. As numerous commenters point out, there is no need to protect terrestrial operations through the establishment of an EPFD limit, nor should the Commission adopt an aggregate PFD "safe harbor." The effectiveness of EPFD limits and/or an aggregate PFD "safe harbor" to protect terrestrial operators is questionable and they would place unnecessary operational constraints on the ability of NGSO FSS systems to deliver next-generation, satellite-based broadband services.

- **Deter speculative applications and spectrum warehousing by maintaining the existing NGSO milestone criteria.** Some commenters ask the Commission to abolish the existing NGSO milestone criteria so they can warehouse spectrum by launching only a portion of their satellites. This regime would be procedurally unmanageable and NGSO operators could satisfy their milestone obligations by launching only a fraction of their

constellation. In order to adequately deter orbital and spectrum warehousing, the Commission should maintain the existing milestone regime and require operators to launch their entire authorized constellation within six years.

- **Consider relying on the ITU coordination process to govern in-line interference events**. Some commenters propose that in lieu of adopting an avoidance of in-line interference mechanism, operators should coordinate their systems based on their respective ITU date priority. OneWeb believes these proposals have merit and should be considered. Although the avoidance of in-line interference mechanism is an essential component of coordination, the ITU date priority is a superior mechanism with substantial coordination regime history. Consistent with this approach, OneWeb believes that the current 10-degree separation angle is not appropriate, and that the coordination trigger angle should be defined by the ITU's Delta-T over T or I/N criteria, due to the widely varying parameters of the various NGSO FSS systems.

- **Reject any requests to mandate particular satellite architectures**. Under the guise of encouraging spectrum sharing, a very small number of commenters suggested the Commission should reward specific satellite architectures. This is squarely at odds with the longstanding Commission practice of encouraging many unique, innovative network architectures and allowing business decisions to drive constellation planning and design. The Commission should also reject any proposals to modify or remove the domestic coverage requirement, which are equally self-serving and inconsistent with the Commission's goals of encouraging broadband deployment in rural and underserved areas.

- **Allocate additional Ka-band spectrum for NGSO FSS operations.** The record fully supports additional allocations of spectrum to further innovative NGSO-based applications and platforms. In the 18.8-19.3 and 28.6-29.1 GHz bands, OneWeb could support a co-primary GSO allocation *if* certain protections are afforded to NGSO operations. The record additionally supports flexibility with respect to the kinds of terminals that can be deployed in newly-authorized NGSO FSS bands, and the Commission should consider allowing co-primary operations for individually-licensed earth stations.

OneWeb is optimistic that by implementing the foregoing proposals, the Commission will unlock the potential of NGSO FSS systems to meaningfully contribute to bridging the digital divide in the U.S. OneWeb looks forward to playing a leading role in this dynamic marketplace for NGSO-based satellite services.

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**REPLY COMMENTS OF ONEWEB**

WorldVu Satellites Limited, d/b/a OneWeb ("OneWeb") respectfully submits this reply to the comments submitted in response to the Federal Communications Commission's (the "FCC" or "Commission") Notice of Proposed Rulemaking in the above-captioned proceeding.[1]

## I. THE ITU EPFD REGIME PROVIDES REGULATORY CERTAINTY FOR BOTH GSO AND NGSO OPERATORS AND SHOULD BE MAINTAINED IN THE KU-BAND AND ADOPTED IN THE KA-BAND

The Commission requested comments on requiring NGSO FSS applicants to demonstrate compliance with applicable EPFD limits in the Ka-band, similar to the existing rules for NGSO applicants in the Ku-band.[2] The record in this proceeding shows near unanimous support for the adoption of these EPFD limits in the Ka-band. Therefore, the Commission should codify the Article 22 EPFD limits in its rules and reject any suggestions that this well-established international regime no longer remains appropriate.[3]

[1] *In the Matter of Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Notice of Proposed Rulemaking, 31 FCC Rcd 13651 (2016) ("NPRM").

[2] *See* NPRM at ¶ 19.

[3] See Comments of ViaSat, IB Docket No. 16-408, at 12-18 (filed Feb. 27, 2017) ("ViaSat Comments").

### A. The EPFD Limits in the Commission's Rules Adequately Protect Incumbent and Future GSO Operations.

The existing EPFD limits in the Commission's rules apply only to the Ku-band and reflect – except for some implementation details relating to "operational" EPFD limits – the corresponding EPFD limits in the ITU Radio Regulations.[4] OneWeb believes these limits should be maintained and that some procedural aspects related to the operational EPFD limits should be modified, as discussed in Section D below.

In the NPRM, the Commission proposes to adopt the corresponding Ka-band EPFD limits from Article 22 of the Radio Regulations in order to facilitate the additional proposed NGSO FSS allocations.[5] Like the Ku-band limits, the Ka-band EPFD limits in the ITU Radio Regulations were developed after exhaustive analyses by ITU study groups, in which the U.S. (including the Commission and U.S. satellite operators) played a leading role. The EPFD limits have long provided a stable framework for the mutual coexistence of GSO and NGSO satellite networks in these frequency bands. Thus, it is far too premature to consider modifying these well-established limits, particularly in the absence of *any* empirical evidence in the record demonstrating they do not adequately protect GSO networks.

Given the relative stability they provide both GSO and NGSO operators, it is unsurprising that almost every commenter in this proceeding supports the codification of Article 22 of the ITU Radio Regulations into the FCC rules. A strong consensus has emerged: that the ITU Radio Regulations Article 22 EPFD limits and the Resolution 76 Aggregate EPFD limits are sufficient to protect GSO FSS networks from interference from NGSO FSS systems.[6]

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[4] *See* 47 C.F.R. §§ 25.146, 25.208(g)-(m).

[5] NPRM at ¶ 19.

[6] *See, e.g.*, Comments of Boeing, IB Docket No. 16-408, at 9 (filed Feb. 27, 2017) ("Boeing Comments") Comments of SES/O3b, IB Docket No. 16-408, at 19 (filed Feb. 27, 2017)

ViaSat, however, explicitly rejects the premise "that the ITU's [EPFD] limits provide adequate protection from NGSO interference."[7] Based on this belief, ViaSat asks the Commission to "carefully examine the impact that operating environment may have on the prospects of NGSO-GSO sharing before simply codifying the *ad hoc* practice developed to allow one particular type of NGSO FSS constellation to operate on an unprotected basis with respect to GSO FSS networks in [the 17.8-18.6 GHz, 19.7-20.2 GHz and/or 29.5-30 GHz bands]."[8]

OneWeb believes that ViaSat's concerns regarding the adequacy of the ITU's EPFD limits are unjustified and its suggestion that the Commission should review these established limits is ill-advised. There is nothing *ad hoc* about the Commission's application of the ITU EPFD limits; they are part of a treaty to which the United States is a party. If the FCC were to adopt rules that depart from the established ITU EPFD limits in the Ka-band, it could destabilize the entire FSS sharing framework. This would substantially chill investment in potential NGSO FSS systems at the precise moment when NGSO systems are poised to unlock desperately needed competition in the marketplace for satellite-based broadband services.[9] While this would benefit some incumbent GSO FSS operators by insulating them from NGSO-based competition, U.S. consumers would suffer as new services and technologies were delayed or stymied.

Previous attempts to call into question the efficacy of the ITU's EPFD limits have been explicitly rejected. For example, in the domestic preparations for WRC-15 some U.S. operators suggested that the Ku-band and Ka-band EPFD limits should be reviewed at WRC-19.

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("SES/O3b Comments"); Comments of Telesat, IB Docket No. 16-408, at 6 (filed Feb. 27, 2017) ("Telesat Comments").

[7] ViaSat Comments at 11.

[8] *Id.*

[9] For example, pending NGSO applications for U.S. market access – including ViaSat's own – may be delayed pending the development of new or revised EPFD limits.

However, this idea was not supported during the U.S. preparatory process, and the delegation to the WRC called for studies of EPFD in other bands. As a result, Resolutions 157 (WRC-15) and 159 (WRC-15) are appropriately limited to studies for the C-band and V-band, respectively.[10] Any action by the FCC to unilaterally reexamine the EPFD regime – which is unquestionably the backbone of the NGSO/GSO sharing framework – would be without support either in the record of this proceeding or the international FSS community.

The Commission cites the need to "provide greater certainty regarding the compatibility of NGSO FSS and GSO FSS operations" in its proposal to adopt the Article 22 EPFD limits.[11] Any action by the Commission to reconsider the current Article 22 EPFD limits would produce precisely the opposite effect: introducing unacceptable uncertainty at a critical juncture in the evolution of innovative NGSO FSS constellations. The satellite industry (both GSO and NGSO) thrives when there is regulatory certainty, which these established EPFD limits have long provided. Therefore, it is critical the Commission reject ViaSat's attempt to undermine this carefully balanced and well-established international regime.

### B. The Inherently Global Nature of NGSO Constellations Mandates Symmetry Between Applicable ITU and FCC EPFD Limits.

Most of the currently proposed NGSO FSS systems are global in nature. Consistency between the Commission's rules and the fundamental GSO/NGSO frequency sharing parameters, including the ITU's EPFD limits that apply to NGSO systems, is crucial. To create a

[10] Resolution 157 (WRC-15), stating that m "Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3700-4200 MHz, 4500-4800 MHz, 5925-6425 MHz and 6725-7025 MHz frequency bands allocated to the fixed-satellite service," World Radiocommunication Conference (Geneva, 2015); Resolution 157 (WRC-15), "Studies of technical, operational issues and regulatory provisions for new non-geostationary fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space)," World Radiocommunication Conference (Geneva, 2015).

[11] NPRM at ¶ 19.

regulatory environment where NGSO satellites would be required to operate their constellations in a drastically different manner when serving the U.S. would place a heavy and unreasonable burden on NGSO operators. Such a regulatory environment would discourage NGSO operators from investing and building out innovative networks in the U.S.

In order to efficiently design and construct NGSO constellations, compliance mechanisms with a specific set of EPFD limits should be incorporated into an NGSO network from the very earliest design stages. Thus, a requirement for an NGSO system to adapt to different EPFD limits in different countries would be extremely onerous and would inevitably compromise the design of the NGSO system. This would impact not only the performance and capacity of the NGSO system, but also its potential economic viability. It is therefore imperative that the Commission ensure consistency between any EPFD limits it adopts in this proceeding and those limits that are already well-established in the ITU Radio Regulations.

In its Comments, OneWeb explained the genesis of the EPFD limits at WRC-2000 and drew the Commission's attention to the different limits contained in the two parts of the Ka-band: namely the 17.8-18.6/27.5-28.6 GHz portion and the 19.7-20.2/29.5-30 GHz portion. OneWeb still believes the "FCC should consider adopting the two sets of EPFD limits in both bands, and allow the NGSO FSS licensee or grantee to meet either set of single-entry limits from Tables 3G or 4G at its discretion."[12] However, should the Commission not agree with this added flexibility, OneWeb strongly favors the adoption of the actual ITU Article 22 limits in these two respective portions of the Ka-band. Should there be support for the idea above in other reply comments, OneWeb is willing to work with the Commission and the FSS community to explore how this could be implemented in practice, especially with respect to the aggregate EPFD limits.

[12] OneWeb Comments at 23.

### C. The FCC Should Adopt the Aggregate EPFD limits from Resolution 76 Without Concern for the Number of Authorized Systems.

Although most commenters supported the Commission's proposed adoption of the ITU RR Resolution 76 Aggregate EPFD limits in the Ka-band, Inmarsat[13] and ViaSat[14] expressed concerns about a perceived lack of any mechanism to enforce the aggregate limits. Both companies seem to misunderstand the concept of aggregate EPFD limits and the relationship of these aggregate EPFD limits to the single-entry validation limits. Both Inmarsat and ViaSat make reference to 3.5 NGSO FSS systems[15] as some sort of boundary after which the aggregate limits would be exceeded, and therefore argue the Commission should adopt some undefined mechanism[16] to ensure protection of GSO FSS networks in case there are more than 3 operational NGSO systems. Inmarsat acknowledges the importance of not impeding the continued development of NGSO FSS systems, suggesting the FCC allow NGSO operations pursuant to RR No. 5.484A until "a mechanism is in place" to address aggregate interference.[17] OneWeb believes that Inmarsat's concerns can easily be addressed and alleviated by traditional

[13] Comments of Inmarsat, IB Docket No. 16-408, at 8 (filed Feb. 27, 2017) ("Inmarsat Comments") ("Inmarsat proposes that the Commission adopt a mechanism to ensure that the aggregate EPFD limits are met.").

[14] ViaSat Comments at 11 ("[N]o mechanism has been proposed to ensure that any aggregate EPFD limits are honored and that critical GSO operations are protected."). These words, or similar comments, are repeated no less than six more times in its submission at ii, 11, 12, 13, 14 and 25, highlighting ViaSat's concern regarding aggregate EPFD.

[15] *See* ViaSat Comments at 12; Inmarsat Comments at 8. ITU Resolution 76, states that "these single-entry validation limits have been derived from aggregate epfd masks contained in Tables 1A to 1D, assuming a maximum effective number of non-GSO FSS systems of 3.5." ViaSat quotes this portion of the Resolution in its comments at n. 35 of the ViaSat Comments.

[16] Both companies suggest the adoption of a mechanism but do not define what such a mechanism would look like, or whether it can be effectively implemented.

[17] Inmarsat Comments at 8.

inter-operator coordination among NGSO FSS operators to ensure that these systems meet the aggregate EPFD limits.

ViaSat, on the other hand, suggests that the aggregate limits be apportioned between the eleven applicants in the current NGSO FSS processing round in the Ku and Ka-band, in which they are also an applicant.[18] This proposed apportionment of EPFD limits among NGSO FSS applicants demonstrates a vital lack of understanding of the aggregate to single-entry limit process. Similarly, ViaSat suggests the Commission may need to adopt an aggregate EPFD limit on the Earth-to-space direction, which currently does not exist in Resolution 76 (Rev. WRC-15).[19]

ViaSat's request for an eleven-way (or more) apportionment of aggregate EPFD limits and the adoption of an uplink EPFD aggregate limit are not only unwarranted but seriously threaten to thwart further development of innovative NGSO constellations that could be launched within the coming years. There are fundamentally sound reasons why the ITU decided to include the single-entry limits in an Article of the Radio Regulations, but left the aggregate levels in a Resolution which does not contain aggregate $EPFD_{up}$ values.[20] It is first necessary to consider the exact language of the resolution, which clearly indicates the number of NGSO FSS systems that coexist may be larger than the 3.5 "effective number" of non-GSO FSS systems, while together still complying with the aggregate EPFD limits.[21] The rationale here is that each system must meet every point (or connected segment) of the single-entry validation limits, so in

[18] ViaSat Comments at 15.

[19] *Id.*

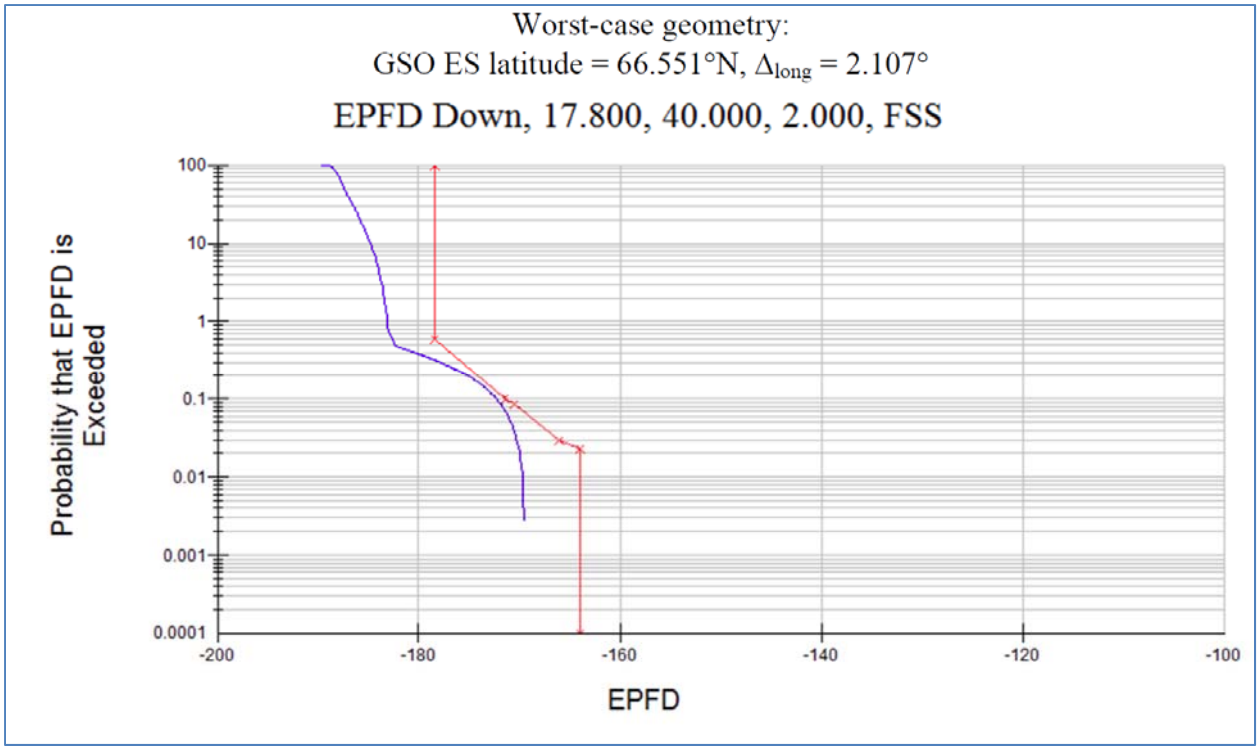
[20] *See* ITU Radio Regulations Resolution 76 (Rev. WRC-2015).

[21] Resolution 76 states "that, as a result of this likely inhomogeneity, the aggregate epfd levels from multiple non-GSO FSS systems *will not be directly* related to the actual number of systems sharing a frequency band, and the number of such systems operating co-frequency is likely to be small." (emphasis added).

reality each system is likely to have an EPFD curve which is well below the masks specified in Article 22. No NGSO FSS system can follow that mask exactly, *i.e.*, touch every point of the EPFD curves, as demonstrated in the figure below taken from OneWeb's market access application in the Ku and Ka-bands.[22] Therefore, even if more than 3.5 operational systems coexist on the same frequency (and it is unlikely that so many systems will actually be deployed in the Ka-band), each system's EPFD values would generally be well below the overall mask and each system would have a different EPFD shape, based on their orbit altitude, GSO orbit avoidance strategy, and power levels.

Furthermore, every NGSO system must avoid co-frequency operation with all other operators during in-line events. As a result, when one system has a satellite in the path between a GSO satellite and its corresponding earth station, any other NGSO system also within this same path necessarily is taking avoidance measures relative to the first NGSO system. Therefore, there is no aggregation during such in-line events and for the short-term portion of the EPFD curve there is no power aggregation.

[22] *See* IBFS File No. SAT-LOI-20160428-00041, Technical Annex at A2-7 ("OneWeb Market Access Application").




ViaSat's claims with respect to uplink aggregate EPFD are similarly misguided.[23] The same reasons that multiple NGSO FSS systems will not aggregate power levels to cause unacceptable interference into GSO FSS systems are applicable for the uplink direction. Within a small satellite footprint, there cannot be more than a few earth stations transmitting co-frequency and causing the maximum EPFD level into a given GSO orbital position. This is true even if there are multiple constellations authorized by the Commission because every NGSO system must coordinate its operation with all other systems.

For these reasons, the Commission should not adopt any further mechanism to address aggregate EPFD levels, apart from requiring operators to ensure their combined operations satisfy the Commission's EPFD limits proposed for adoption in § 25.208(h).

[23] *See* ViaSat Comments at 15 ("However, no rule or other mechanism is proposed to manage the risk of aggregate interference into GSO satellite receivers from the potentially hundreds of thousands (or more) of earth stations that the Commission may license to communicate over the numerous NGSO systems that may be authorized through pending processing rounds.").

### D. There is Support for Modifying the Compliance Showing Requirement for Operational EPFD Limits.

The Commission proposed consolidating the EPFD limits for both the Ka- and Ku-bands in Section 25.146 of the Commission's rules.[24] In its comments, OneWeb argued that incorporating certain parts of Section 25.146(b) of the current rules relating to Ku-band EPFD limits – which require an EPFD compliance showing 90 days *before* commencing service – is impractical and should be modified.[25]

Some commenters agreed with OneWeb that demonstrating compliance with the entirety of Section 25.146 of the Commission's rules is not achievable before a sufficient number of satellites are launched.[26] This principle is true in both the Ku- and Ka-bands, and the language in 25.145(b) should be modified if the Commission adopts the EPFD limits applicable to the Ka-band in RR Tables 22-4B within § 25.208(i) of the FCC rules. As stated by OneWeb and supported by Boeing, a more adequate showing could be made ***after*** commencing service. This would certainly be a better representation of the intent and spirit of the Article 22 operational EPFD limits which are meant to protect operational GSO FSS earth station and not some simulated version of such earth stations. For this reason, the Commission should also reject SES/O3B's claim that compliance with operational limits should be demonstrated at the time of the submission of an application.[27]

[24] NPRM at ¶ 20.

[25] OneWeb Comments at 25-26.

[26] *See, e.g.,* Boeing Comments at 9-10.

[27] *See* Comments of SES/O3b at 20.

### E. There is No Current Need for the Commission to Adopt Earth Station EIRP Limits.

Some commenters – including LeoSat, Space Norway and SES/O3b – support the adoption of earth station e.i.r.p. limits for NGSO FSS systems, while others – such as Boeing, OneWeb and Telesat – do not.[28] The supporters argue that off-axis e.i.r.p. limits are necessary to ensure the avoidance of in-line events can be properly quantified and that no excessive interference occurs outside the pre-defined in-line avoidance angle. This argument is flawed because it is based on the concept that NGSO FSS proponents will not coordinate their systems with each other, and that one of the two systems (presumably the one with lower ITU priority) will take avoidance measures only to account for the Commission's required avoidance angle. For example, the comments from LeoSat are confusing in that they support earth station e.i.r.p. limits to "manage incidents of interference outside the trigger angle" but do not support minimum earth station receive antenna gain, since it "likely would restrict the types of antennas that may be selected for the provision of NGSO service."[29] However, if a receive antenna gain restricts the deployment of small terminals, so will imposing earth station off-axis e.i.r.p. limits.

OneWeb believes the issue of in-line interference avoidance and other related operational parameters such as earth station e.i.r.p. masks are best left to be resolved by operators during inter-system coordination. Should the Commission decide that such measures would be useful, it should wait until sufficient operational experience has been gained from the actual deployment of NGSO FSS systems and commence a future rulemaking process as necessary.

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[28] *See* Comments of LeoSat MA, Inc., IB Docket 16-408, at 14-15 (filed Feb. 27, 2017) ("LeoSat Comments"); SES/O3B Comments at 27-28; Comments to the Notice of Proposed Rulemaking, Space Norway, IB Docket 16-408, at 13 (filed Feb. 27, 2017) ("Space Norway Comments"); Telesat Comments at 17; OneWeb Comments at 27-28; Boeing Comments at 15-17.

[29] LeoSat Comments at 13-14.

## II. INCUMBENT TERRESTRIAL SYSTEMS ARE FULLY PROTECTED BY THE COMMISSION'S CURRENT PFD LIMITS

### A. Aggregate PFD Limits are Unnecessary to Protect NGSO Systems.

It is well-established that the purpose of the PFD limits in Article 21 of the ITU Radio Regulations for GSO and NGSO satellite networks is to protect terrestrial services from interference. In the case of an NGSO system, the PFD limits in both the ITU Radio Regulations and the Commission's rules are clearly defined as the limit that applies to an individual satellite in the NGSO system. The effect of the aggregate interference from multiple NGSO satellites in a constellation is taken account of in the "X" and "n" factors in the formulae for the PFD limits.[30]

OneWeb has demonstrated in the OneWeb Market Access Application that an NGSO system can meet these PFD limits, while some other NGSO operators apparently have found this to be quite difficult.[31] If extremely large NGSO constellations are to be deployed, then it may be necessary for the ITU to revisit these PFD limit formulae. However, the Commission should avoid rushing to a quick fix here (such as the adoption of an aggregate PFD limit or the derivation of new terrestrial-specific EPFD limits) which may be unsatisfactory from both the NGSO operators' perspective as well as for the potential victim terrestrial services. A more sensible approach would be for the FCC to encourage further studies within the ITU so that a consistent, globalized solution can be found. Unlike the potential adoption of rules based on the record in this proceeding, this would also allow for real-world, operational characteristics to inform any later decision by the Commission.

[30] The ITU PFD limits include these factors across all the 17.8-19.3 GHz band, whereas the current FCC rules only assume that NGSO systems will operate in the 18.8-19.3 GHz band and so they include these factors only in the PFD limits that apply in this sub-band.

[31] *See, e.g.,* Comments of Space Exploration Technologies Corp., IB Docket No. 16-408, at 8-10 (filed Feb. 27, 2017) ("SpaceX Comments").

As OneWeb stated in its initial comments, it is inconceivable that a global NGSO FSS system could benefit from additional PFD flexibility over the U.S. while having to meet the more stringent ITU limits everywhere else, including in Canada and Mexico.[32] This is especially true for that the portion of the ITU PFD mask that seems of concern to the proposal's supporters: LeoSat, SpaceX, and Telesat. In particular, it is quite surprising that Telesat prefers the Commission adopt an aggregate PFD of -115 dBW/$m^2$ per MHz for its entire constellation, considering that its "hybrid" constellation is not considered very large, and at 117 total satellites, the ITU formulation represents a 2dB reduction in PFD at low arrival angles below 5 degrees.[33] SpaceX wants even greater relief from PFD compliance than the Commission proposed, asking the Commission to also adopt a second aggregate value of -105 dBW/$m^2$ per MHz for higher elevation angles.[34] This second -105 dBW/$m^2$ per MHz is as unnecessary as the proposed -115 dBW/$m^2$ per MHz "safe harbor" and should be rejected. Furthermore, neither of these aggregate PFD limits have been proven to protect terrestrial fixed stations. Unlike the ITU PFD limits that have been studied in ITU-R over the course of two WRC cycles (from 1995 to 2000) with participation of both satellite and terrestrial operators, this "aggregate PFD" concept has never been studied.

Unsurprisingly, many commenters did not support this approach. As Boeing correctly points out, an aggregate PFD safe harbor of -115 (dBW/$m^2$)/MHz "would be excessively and unnecessarily burdensome to NGSO FSS systems."[35] SES/O3b expressed similar concerns, noting that "[t]his limit would be too constraining for operations at high elevation angles where

[32] *See* OneWeb Comments at 22.

[33] Telesat Comments at 5.

[34] SpaceX Comments at 11.

[35] Boeing Comments at 8.

the gain of the victim terrestrial stations rolls off substantially in the direction of the NGSO satellite."[36] OneWeb agrees with Boeing and SES/O3b and restates its opposition to the Commission's unnecessary proposal to adopt a "safe harbor" PFD level.

### B. The Commission Should Not Stymie the Growth of NGSO Systems by Prematurely Adopting an EPFD Metric for Terrestrial Systems.

In the NPRM, the Commission solicited comments on potentially using EPFD limits to protect terrestrial stations.[37] In its Comments, OneWeb argued that EPFD is an inappropriate metric by which to protect terrestrial services since it has never been studied.[38] The record in this proceeding does not justify such an approach and the Commission should refrain from adopting an EPFD metric to protect terrestrial operations.

OneWeb agrees with SES/O3b that PFD limits "can be relied upon to protect terrestrial fixed services" and therefore, like SES/O3b, it cannot support an EPFD limit for the protection of terrestrial stations.[39] Although some operators expressed support for an EPFD metric to protect terrestrial stations, their concerns are misplaced.[40] There is nothing in the record that convincingly demonstrates that the Commission's existing PFD limits in Section 25.208 of the Commission's rules are inadequate to address interference into terrestrial stations.[41] As OneWeb previously advocated, adoption of the current ITU Article 21 PFD limits across the shared portion of the Ka-band is the most efficient way to ensure that terrestrial stations do not receive

[36] SES/O3b Comments at 19.

[37] NPRM at ¶ 16.

[38] OneWeb Comments at 20.

[39] SES/O3b Comments at 18.

[40] *See e.g.*, Telesat Comments at 5.

[41] 47 C.F.R. § 25.208(e).

harmful interference while also ensuring that the many NGSO FSS systems designed pursuant to these rules become operational.

The adoption of an EPFD metric to protect terrestrial stations risks slowing development of NGSO constellations and adding additional costs. As primarily global constellations, any departure from the ITU's PFD-based regime would force NGSO systems to operate their constellations under two different sets of protection criteria for terrestrial operations. For example, OneWeb questions how an NGSO FSS system could provide service outside the United States if it is incapable of meeting the current ITU Article 21 PFD limits which are more restrictive at low angles of arrival than the proposed "safe harbor" limits.

In the presence of a thriving NGSO FSS marketplace, the Commission should refrain from adopting such a metric until interference studies have been completed and accepted in the ITU-R forum. To do otherwise would be to prematurely and unnecessarily compromise the ability of NGSO FSS systems to deliver critical satellite-based services.

## III. IN ORDER TO DETER SPECULATION AND WAREHOUSING THE COMMISSION SHOULD CONTINUE TO REQUIRE NGSO LICENSEES TO LAUNCH AND OPERATE THEIR ENTIRE AUTHORIZED CONSTELLATION WITHIN SIX YEARS

The NPRM tentatively concluded to modify the six-year milestone obligation to allow an operator to fulfill this requirement by launching and operating 75% of its authorized constellation.[42] The Commission also requested comment on alternative approaches for NGSO operators to fulfill the milestone obligation, including allowing operators to fulfill the milestone requirement by instead launching and operating a specific number of satellites.[43]

[42] NPRM at ¶ 32.

[43] NPRM at ¶ 33.

In its initial comments, OneWeb urged the Commission to refrain from relaxing the existing milestone obligation requiring operators to launch 100% of their constellation within six years of a license or market access grant.[44] Several commenters asked the Commission to adopt an alternative proposal and allow operators to fulfill the milestone obligation by launching a tiny fraction of their authorized constellation under the guise of providing "substantial service."[45] These commenters articulated no compelling rationale justifying such a radical departure from the Commission's well-established milestone regime. Accordingly, the Commission should continue to require operators to launch and operate their entire constellation in six years.

OneWeb believes maintaining the existing milestone regime will help discourage spectrum warehousing. In particular, rural spectrum warehousing – where a company uses the spectrum for populated areas and provides only a promise to connect rural populations at a future date – must be prevented. NGSO FSS spectrum is uniquely suited for rural coverage and the Commission should make every effort to ensure rural Americans are not left on the wrong side of the digital divide.

To that end, OneWeb generally agrees with ViaSat's belief that "[t]he Commission's NGSO milestone requirement is a cornerstone of its policies for ensuring the efficient use of spectrum resources."[46] As the Commission has more specifically stated, "satellite construction milestones. . . are intended to offset the incentives for warehousing behavior that are harmful to both competition and consumers and to encourage the rapid deployment of new spacecraft and

[44] *OneWeb Comments* at 2-7.

[45] *See* Boeing Comments at 17-20; SpaceX Comments at 13-16; Telesat Comments at 17-18.

[46] ViaSat Comments at 21.

the optimal utilization of scarce orbital and spectrum resources."[47] Nothing in the record in this proceeding demonstrates that these important policy objectives would be well-served by further relaxing the existing NGSO construction milestone.

OneWeb is particularly concerned by proposals that suggest the Commission tie the NGSO construction milestone to a vaguely-defined "substantial service" threshold. A few illustrative examples include:

- *Telesat* asks the Commission to require that an NGSO operator "must be in commercial service and must be providing a substantial, commercially viable service consistent with that proposed in its application over a substantial portion of the area proposed to be served by its system."[48]
- *Boeing*'s proposal is even more poorly defined. Boeing requests that NGSO applicants be able to satisfy the milestone obligation by first specifying how many satellites will be required "to satisfy their initial business requirements" and then providing "a reasonable showing regarding its initial business requirements."[49] If the initial milestone is satisfied, Boeing proposes that the rest of the authorized constellation be launched within a *second* six-year framework.[50]
- *SpaceX* eschews its own 75% milestone proposal as well as any "arbitrary term of years in which to launch and operate the entire constellation authorized."[51] Instead, SpaceX advocates for the Commission to allow an operator to specify "the minimum

[47] *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Second Report and Order, 30 FCC Rcd 14713, 14735 ¶ 53 (2015) ("*Second Report and Order*").

[48] Telesat Comments at 18.

[49] Boeing Comments at 18.

[50] *Id*. at 19.

[51] SpaceX Comments at 16.

number of satellites with which it intends to begin its intended service" and then apply the substantial service standard currently applicable to some wireless licensees. A subsequent milestone would involve "phase objectives. . . based on the development plan for its system."[52] SpaceX's initial deployment evidently will also not be capable of providing full U.S. coverage.[53]

As SES/O3b correctly points out, this mechanism is flawed because "it would be difficult to identify useful common metrics for determining whether systems are meeting an agreed threshold service requirement."[54] Beyond the obvious logistical challenges in applying this "standard," there is also a troubling theme running throughout these proposals: an eagerness on the part of certain NGSO operators to cling to significant orbital and spectrum resources without any corresponding intention or ability to launch more than a mere fraction of their authorized constellation within six years.

Clearly, the proposals advanced by these commenters do not constitute the kind of regulatory environment that will serve as an adequate deterrent to speculative applications and the resulting spectrum warehousing. In previous proceedings seeking to streamline satellite regulations, the Commission explicitly recognized that "ensuring. . . adequate means to prevent warehousing is crucial to achieving the goals of this proceeding."[55] Almost fourteen years later, OneWeb believes that these same considerations should govern the instant proceeding. The Commission's abiding regulatory imperative should still be to ensure spectrum warehousing is

[52] *Id.* at 15.

[53] *See* IBFS File No. SAT-LOA-20161115-00118, Waiver Requests at 13-14 (filed Nov. 15, 2016) ("SpaceX Market Access Application").

[54] SES/O3b Comments at 34.

[55] *In the Matter of Amendment of the Commission's Space Station Licensing Rules and Policies; Mitigation of Orbital Debris*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760, 10835 ¶ 199 (2003).

not preventing those operators "willing and able to move forward with their business plans from attempting to provide service to the public in a timely manner."[56] Therefore, the Commission should reject these proposals to implement a "substantial service" standard as the applicable NGSO milestone.

OneWeb continues to believe there is no compelling reason to alter the current NGSO milestone regime of six years, but it reasonable to "soften" the consequences of not meeting the initial milestone: instead of rendering the authorization null and void, the number of satellites in the authorized constellation would be reduced to the level actually in orbit.[57] This represents an appropriate regulatory balance that provides some additional flexibility for NGSO operators without rendering the NGSO milestone mechanism toothless.

## IV. THE RECORD DEMONSTRATES THE COMMISSION SHOULD CONSIDER RELYING ON ITU PRIORITY TO GOVERN IN-LINE INTERFERENCE EVENTS IN ALL AUTHORIZED NGSO FSS BANDS

The NPRM requested comments on codifying the avoidance of in-line interference mechanism as the default mechanism to enable spectrum sharing in the Ku- and Ka-bands as well as the potential application of this mechanism in other NGSO-authorized bands.[58] In response, Telesat and LeoSat proposed the Commission should instead allow NGSO licensees and grantees to rely on the ITU coordination process.[59] Although OneWeb supported codification of the avoidance of in-line interference mechanism in its initial comments, OneWeb believes that the approach suggested by Telesat and LeoSat also has merit. Therefore, OneWeb requests the Commission consider relying on the ITU coordination priority in lieu of band

[56] *Id*.

[57] NPRM at ¶ 32.

[58] NPRM at ¶¶ 22-23.

[59] *See* LeoSat Comments at 11-13; Telesat Comments at 6-15.

segmentation when applying the avoidance of in-line interference mechanism in NGSO-authorized bands.

### A. ITU Priority is a Clear, Administrable Guideline Consistent With the International Nature of NGSO FSS Satellite Systems.

The Commission should consider allowing NGSO operators to adhere to the ITU coordination process to avoid mutual inter-system interference, and to rely on ITU priority as defined by the date of receipt of the AP4 (coordination request information) in the case of in-line interference events. Practically, relying on ITU coordination to resolve in-line interference events will provide increased certainty with respect to interference protection from later entrants. As a result, NGSO operators will be able to make significant investments in their satellite constellations with confidence that those constellations will not provide deteriorated service in the U.S. as a result of unnecessary spectrum restrictions.[60] At the same time, the Commission will maintain its ability to act swiftly and firmly where an applicant fails to make such investments, therefore creating opportunities for later entrants to operate.[61] This regime best fulfills the Commission's goal of "balanc[ing] the competing interests of encouraging new market entry and providing NGSO FSS operators certainty with respect to a minimum amount of spectrum available for their services."[62]

Under the proposed sharing mechanism, there is currently no provision for ITU date-based priority. Therefore, the amount of spectrum available to a given NGSO operator during an in-line interference event involving a U.S.-licensed earth station could change over time and

[60] Any system that cannot complete ITU coordination with prior-filed networks will suffer significant restrictions globally during in-line events with other NGSO systems which have ITU priority.

[61] *See* Section III, *supra* (supporting the current milestone requirement as an effective method of deterring spectrum warehousing).

[62] NPRM at ¶ 27.

would be impossible to predict at the time when constellation modeling and investment decisions are made. Some operators may be reluctant to make significant investments in a system that may lose access to a significant amount of spectrum during in-line interference events, reducing the available throughput and degrading the service available to U.S. customers. Even worse, if the operator cannot accurately predict what the reduction in available spectrum may be or how often it may occur, planning and network investment activities will not just be unattractive – they will be extremely difficult to conduct.

This problem is exacerbated by the sheer number of planned NGSO FSS constellations. As more satellites are placed in orbit, in-line interference events will become more common, if not ubiquitous. In a worst-case scenario, a large constellation may experience an in-line interference event involving one or more of its satellites almost constantly. This is an unfair and unnecessary burden to place on an operator that undertook an enormous investment as well as the inherent risk of being a first mover, instead of appropriately placing this burden on later entrants. As Telesat correctly points out, frequent sharing obligations are likely to end up being functionally equivalent to band segmentation, a sharing mechanism uniformly rejected by commenters in this proceeding,[63] as well as the Commission in previous decisions.[64] A sharing mechanism with no provision for ITU date priority could potentially leave all operators with insufficient bandwidth the majority of the time. This is not an ideal result for satellite stakeholders, least of all potential customers in unserved and underserved markets. Instead, it would be more efficient to allow each new applicant to decide as it enters the market whether the

[63] Telesat Comments at 14.

[64] *See In re Fixed Satellite Service in the Ka-Band*, 18 FCC Rcd 14708, 14714 ¶ 21 (2003) (rejecting band segmentation sharing options in the Ka-band); *In re Establishment of Policies & Service Rules for Non-Geostationary Satellite Orbit, Fixed Satellite Service in Ku-Band*, 17 FCC Rcd 7841, 7851 ¶ 34 (2002)("*Ku-band Sharing Order*") (rejecting band segmentation sharing options in the Ku-band).

available spectrum is enough to support its proposed operations and to coordinate its operations accordingly, just as it has to do in every other jurisdiction in which it intends to provide service.

Using ITU date priority to govern permissible actions during in-line interference events has the additional benefit of aligning the Commission's rules with the ITU rules that govern in all other jurisdictions. This would allow NGSO FSS operators – most of whom are global in nature – to design their systems to function under a single set of global rules, rather than having to choose spectrum allocations and constellation configurations that will operate under two very different sets of sharing mechanisms. Since date priority provides a bright-line standard, it would also provide operators with certainty with respect to their allocated spectrum. This will prevent situations where an NGSO operator purposely overestimates the spectrum it will need because of the likelihood of experiencing reductions in available spectrum during in-line interference events.

Of course, implementation of a regime based on ITU priority during in-line events should not replace voluntary coordination agreements; to the contrary, such a system would further incentivize active coordination. For example, under the current regime, some NGSO operators with low ITU date priority may have little incentive to coordinate with other operators because of the likelihood that, as later-filed systems, they will need to more frequently undertake in-line avoidance and/or interference mitigation techniques. Instead, these operators would prefer to avoid executing coordination agreements and rely on the FCC's rules, which provide that (i) they will have some small amount of spectrum on which to operate and (ii) their competitors with higher ITU date priority will be impaired. This "race to the bottom" can be rectified by incentivizing *all* operators to coordinate their systems by adopting the ITU's coordination

procedures generally, and relying on ITU priority during in-line events, as opposed to band segmentation.

Coordination between parties, where feasible, should always be the preferable option for dealing with interference because of the likelihood that NGSO operators will be able to reach an agreement that leaves both parties with access to their preferred spectrum. However, in case the parties are not able to reach a voluntary coordination agreement, some fallback position must be implemented. In the absence of a coordination agreement, an in-line interference mechanism based on the ITU's coordination procedures provides the most rational and efficient method to govern in-line interference events.

### B. A Trigger Angle Should Not Be Used to Determine the Occurrence of In-Line Interference Events.

In the NPRM, the Commission requested comments on the appropriate separation-angle trigger to define in-line interference events.[65] In its comments, OneWeb questioned the usefulness of the 10-degree default angle and asked the Commission to continue to study and monitor the matter. Other commenters also questioned the continuing utility of the 10-degree angle and suggested that the Commission adopt an avoidance angle smaller than 10° or some other criteria to avoid interference.[66] After conducting further analyses, OneWeb believes that the 10-degree separation angle is neither justified nor necessary.

The appropriate trigger angle is the one that permits operation of the two concerned NGSO systems, and as such is highly dependent on the system characteristics of the two systems. For example, the 10-degree avoidance angle may be acceptable for systems employing intermediate size antennas for their earth stations but may not be sufficient if one of these

[65] NPRM at ¶ 26.

[66] *See, e.g.*, Boeing Comments at 12; Telesat Comments at 9-10; SES/O3b Comments at 25.

systems employs very small terminals, or uses higher power than the other. Conversely, a 10-degree trigger angle may be overly restrictive for an NGSO FSS system to protect another system, should the first employ large antennas with low off-axis e.i.r.p. levels. For these reasons, OneWeb believes that the solution lies in inter-system coordination and that during in-line events the Delta-T (or I/N) criteria should be used to determine the angle necessary for one system to protect another, and vice-versa. The processing round applications clearly show the lack of homogeneity in the various filed constellations which make a single trigger angle to define "in-line events" impractical.

## V. THE COMMISSION SHOULD MAINTAIN A LEVEL PLAYING FIELD AND NOT PENALIZE CERTAIN NGSO FSS SYSTEM DESIGNS BY DECREASING AVAILABLE SPECTRUM DURING IN-LINE INTERFERENCE EVENTS UNDER THE GUISE OF FACILITATING SPECTRUM SHARING

### A. As It Has in Other Contexts, the Commission Should Refrain from Mandating Specific Satellite Network Architectures.

In the current proceeding, the Commission seeks to facilitate sharing among NGSO and GSO systems and terrestrial uses of spectrum, taking into account the varying size, uses, and network architectures of each system, as well as any "emerging uses, technologies, or platforms" that users of the spectrum may employ.[67] OneWeb supports this effort to make technology neutrality a priority, striving to accommodate all types of systems rather than artificially limiting the types of service and price points available to consumers by mandating the use of certain technologies.

The Commission has historically encouraged innovation and diversity in satellite system design. The Satellite Division's stated mission includes "minimizing regulation and maximizing

[67] NPRM at ¶ 17.

flexibility for satellite telecommunications providers to meet customer needs."[68] The Commission has generally adopted technology-neutral rules where possible – for instance, rejecting a "homogeneous constellations" method of ensuring spectrum sharing in the Ku-band because it preferred to leave providers "free to design any constellation and any service offerings best suited for their business plans and the markets they seek to serve";[69] adopting a more flexible off-axis e.i.r.p. density envelope for earth stations in the Ka- and Ku-bands in order to accommodate different antenna constructions;[70] and adopting a functional rather than a design-based definition of "earth station" for purposes of NGSO FSS earth station operations in the Ku-band, to avoid "hinder[ing] innovation and flexibility."[71]

Given the Commission's well-established commitment to design flexibility, it was surprising to see two commenters suggest the Commission should implement rules that punish certain satellite network architectures and reward systems deploying narrow transmit beams at the expense of more expansive geographic coverage. For example, Kepler Communications implausibly suggests that the Commission should find ways to impose "negative externalities" on certain types of satellite architecture or technology.[72] Similarly, SpaceX brazenly suggests the Commission should reward certain network architectures – such as those employing steerable beams and satellite diversity – with additional spectrum during in-line interference events while

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[68] International Bureau Satellite Division, https://www.fcc.gov/general/international-bureau-satellite-division.

[69] *Ku-band Sharing Order*, 17 FCC Rcd at 7851 ¶ 31.

[70] *Second Report & Order*, 30 FCC Rcd at 14775-76 ¶ 183.

[71] *In re Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range*, First Report & Order & Further Notice of Proposed Rulemaking, 16 FCC Rcd 4096, 4112 ¶ 30 (2000).

[72] Comments of Kepler Communications, IB Docket No. 16-408, at 4 (filed Feb. 27, 2017) ("Kepler Comments").

penalizing systems whose beams are larger than an arbitrary "safe harbor downlink bandwidth."[73] This proposal is directly at odds with the Commission precedent described above, adopting technology-neutral approaches to regulation. Unsurprisingly, it is wholly without other support in the record. As such, the Commission should decline the invitation to give SpaceX an unnecessary and undeserved competitive advantage and instead should reinforce its long-standing commitment to not pick winners and losers in the satellite marketplace.

The Comments in this proceeding illustrate the wide variety of innovative technologies that can be deployed across satellite spectrum to serve different markets; these constellations each reflect satellite architectures capable of serving varied customers and business models. Together, these proposed systems constitute precisely the kind of dynamic, innovative marketplace the Commission has long sought to foster. Thus, Kepler's and SpaceX's attempts to mandate specific satellite architectures that suspiciously resemble their own concepts are not only misguided, they are unnecessary.

OneWeb urges the Commission to adopt rules that accommodate and encourage *all* types of satellite network architecture, rather than rules that effectively mandate use of specific technologies. Such rules discourage unique and useful network architectures and limit novel applications by directing development in one direction rather than letting the market drive innovation as the Commission has always encouraged. Furthermore, rules based on unproven technologies of the moment are impractical and short-sighted, and quickly become outdated.

Kepler itself provides a better suggestion in another part of its comments: "[W]here new technology can provide the means to facilitate spectrum sharing without interference, regulations

[73] SpaceX Comments at 27.

should *enable* systems to do so."[74] The Commission should certainly allow for the deployment of interesting technologies if investors are willing to fund them. But long-established Commission policies, as well as the record in this proceeding, do not support a mandate for the use of any specific satellite technology. Accordingly, the Commission should not interfere with the thriving NGSO marketplace by effectively – and inappropriately – mandating certain satellite network architectures.

### B. Wider-Beam Architectures Are Necessary to Provide Truly Global Coverage to Unserved and Underserved Markets, While Some of the "Innovative" Technologies Proposed Would Result in Very Large Constellations that Do Not Provide Global Coverage.

SpaceX failed to address the potentially drastic consequences likely to occur as a result of its proposal to mandate or incentivize certain network architectures. Some of the technologies that SpaceX suggests should be incentivized or even mandated would hinder satellite coverage of remote areas of the U.S. and the world, or alternately render such coverage unreasonably expensive. This would conflict with Chairman Pai's renewed commitment to bringing broadband to rural and remote areas of the U.S.[75] In contrast to SpaceX's system of narrow beams, wider-beam coverage like that employed by OneWeb's initial constellation enables NGSO systems to reach a wider geographic area and more users with fewer satellites in orbit. In

[74] Kepler Comments at 2 (emphasis added).

[75] *See, e.g.*, "Oversight of the Federal Communications Commission," Testimony of FCC Chairman Ajit Pai Before the Senate Commerce, Science & Transportation Committee (March 8, 2017), *available at* https://www.commerce.senate.gov/public/_cache/files/1fddbd8c-9bb6-44ab-a7d8-1ab89da5f5d0/936B3691CAD02C993A6898846B691A97.pai-testimony.pdf ("[T]here are still too many parts of this country where broadband is unavailable or unaffordable. . . In wealthier, metropolitan areas, 4G LTE is ubiquitous, and gigabit fixed service is expanding. But many rural areas are being left behind. . . I've been to the far reaches of Alaska and heard from Alaska Natives that a lack of middle-mile connectivity has made it harder to connect their communities. And I have listened to people in Kansas and South Dakota and Nevada and Mississippi and elsewhere who worry that without broadband, they and their children won't have the ability to compete and prosper in the 21st century.").

addition, OneWeb's global coverage ensures the poorest markets will not be left behind due to larger markets exhausting satellite capacity and forcing the steerable beams to focus on only the most lucrative markets. This was a specific design choice by OneWeb to ensure access for everyone.

OneWeb's system was designed to achieve global coverage and reach the most underserved corners of the world in a cost-effective manner. OneWeb will be able to provide truly global coverage – a feat simply not achievable by other proposed NGSO systems. The technologies SpaceX seeks to mandate – narrow, steerable beams and satellite diversity – if actually built and deployed, would require very large satellite constellations that, on their own, are incapable of achieving such truly global coverage. While these systems may facilitate and augment spot capacity in high density areas, they are burdened by certain inherent limitations.

For example, satellite diversity, while it promotes handover in the case of in-line interference events, also necessitates launching a huge number of satellites to ensure redundancy; narrow and steerable beams may accurately target a constricted area, but they limit the amount of simultaneous geographic coverage that is achievable. In its recent NGSO Ka- and Ku-band application, SpaceX proposes to operate 4,425 satellites operating in 83 orbital planes.[76] Such large constellations, if actually built and launched, would theoretically be technically suitable for providing very high-capacity broadband to a few (targeted, densely populated) areas at a time. But they crowd orbits with huge numbers of satellites and fail to promote critical broadband access for unserved or underserved areas. Moreover, history has shown such large satellite projects tend to become more expensive over time and eventually the funding dries up (if it ever appears). Thus, the deployment of different satellite technologies – capable of serving different

[76] *See* SpaceX Market Access Application, Legal Narrative at 1.

markets and customers – should remain a business decision for NGSO operators and not a regulatory consideration to be rewarded or penalized by the Commission.

### C. The Record Indicates There is Not Adequate Support for Removing the Domestic Coverage Requirement.

Related to its request to reward certain narrow-beam architectures, SpaceX suggests that the domestic coverage requirement in Sections 25.145(c)(2) and 25.146(i)(1) should be deleted.[77] This question is outside the scope of the NPRM and there is no other support in the record for deleting this requirement. Unlike the global coverage requirement, which multiple commenters suggest is unnecessary and unduly restrictive,[78] the domestic coverage requirement is not opposed by other commenters. This requirement serves a vital public interest purpose for the United States: namely, ensuring that broadband coverage is made available even in remote and underserved areas of the country. For example, if NGSO operators are allowed to ignore Alaskan coverage in favor of high-density locations in California, the public interest will not be served and Alaska will never have true broadband. Moreover, any NGSO system which does provide global coverage will have to operate at a financial disadvantage to those designed just for the densely populated areas. While this may be a rational financial decision, it does not help bridge the digital divide in the U.S.

This is entirely consistent with the Commission's current goal of using all available technological platforms to expand quality broadband access to every U.S. household.[79] If this

[77] SpaceX Comments at 24.

[78] *See*, *e.g.*, Boeing Comments at 20; Space Norway Comments at 14; SES/O3b Comments at 35.

[79] *See* Remarks of Ajit Pai, January 24, 2017, *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db0124/DOC-343184A1.pdf (on his first day as Chairman, Chairman Pai addressed the digital divide and stated that "one of our core priorities going forward should be to close that divide—to do what's necessary to help the private sector build networks, send signals, and distribute information to American consumers"); *see also* Federal Communications Commission Strategic Plan 2015-2018, Strategic Goal 3,

requirement were to be deleted, NGSO systems – such as SpaceX's – would be free to disregard those Americans who currently lack adequate broadband access. This is not an acceptable outcome. Simply put, if the Commission is to tap the potential of NGSO constellations to bridge the digital divide, the domestic coverage requirement must remain. OneWeb urges the Commission to reject SpaceX's proposal and to maintain the domestic coverage requirement.

## VI. THE RECORD FULLY SUPPORTS ALLOCATION OF ADDITIONAL SPECTRUM AND TERMINAL FLEXIBILITY FOR NGSO FSS SYSTEMS

### A. There is Considerable Support for Critical Additional NGSO Allocations in the Ka-Band.

OneWeb, like many of the commenters in this proceeding,[80] supports the Commission's proposals for allocating additional spectrum to NGSO use. In particular, there are several spectrum bands where spectrum use is critical for NGSO operations – the 17.8-18.6, 19.7-20.2, 27.5-28.6, and 29.5-30 GHz bands. Additional access to these frequency bands would enable NGSO operators to establish higher-capacity connections between their satellites, gateway earth stations and end users, ultimately improving the quality of service available and the number of customers who can be served.

In the NPRM, the Commission proposes a new allocation for NGSO FSS use in the 17.8-18.3 and 18.3-18.6 GHz bands.[81] This allocation is consistent with waivers previously granted by the Commission.[82] OneWeb agrees with the Commission's conclusion that NGSO operations

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Performance Goal 3.1.1, *available at* https://apps.fcc.gov/edocs_public/attachmatch/DOC-331866A1.pdf ("Support and facilitate the development, deployment, and adoption of broadband services across multiple platforms").

[80] *See, e.g.*, SpaceX Comments at 3-5; Boeing Comments at 4-5; SES/O3b Comments at 10-13; ViaSat Comments at 7-8.

[81] NPRM at ¶¶ 9-10.

[82] *See, e.g.*, Letter from Jose Albuquerque, Chief, Satellite Division, to Suzanne Malloy, Vice President – Regulatory Affairs, O3b, re: IBFS File No. SES-MSC-20151021-00760, 31 FCC Rcd

in these bands will not negatively impact GSO FSS networks, based on adherence to the ITU's EPFD limits in these bands,[83] or terrestrial uses, based on adherence to PFD limits.[84]

OneWeb also agrees with some commenters who point out that NGSO systems need not operate on a secondary basis to GSO in these bands – these systems can both operate on a co-primary basis, subject to NGSO adherence to the ITU's EPFD limits.[85] OneWeb agrees with Boeing and LeoSat that blanket licensing of user terminals in these bands is workable, provided that blanket-licensed stations operate secondary to, and on an unprotected basis with respect to, terrestrial services.[86] In addition, OneWeb agrees with SES/O3b and LeoSat that individually-licensed earth stations should operate on a co-primary basis with terrestrial services, based on a coordinated first-come, first-served regime.[87] The Commission should also consider co-primary status for individually-licensed earth stations in these bands. These earth stations are critical to support NGSO capability and will still be relatively few in number; for example, four are planned across the United States for the OneWeb system. Thus, there is no increased risk of harmful interference to terrestrial operators.

NGSO FSS operations in the 19.7-20.2 GHz band are already permitted on a secondary basis, and have been permitted on a non-interference basis via waiver, based on demonstrated

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342, 344-45 (Feb. 1, 2016); *In re Inmarsat Mobile Networks, Inc.*, 30 FCC Rcd 2770, 2779 ¶ 25 (2015).

[83] NPRM at ¶ 19 ("we expect that compliance with the Article 22 EPFD limits will be sufficient for NGSO FSS systems to protect GSO FSS networks in the 17.8-18.6 GHz [band]").

[84] NPRM at ¶ 9 ("we anticipate that PFD limits established by the ITU, with significant involvement of the United States, will be adequate to protect U.S. fixed users from interference").

[85] *See, e.g.*, LeoSat Comments at 4.

[86] *Id.*; Boeing Comments at 2-3. OneWeb believes these considerations also apply to certain portions of the Ku-band, where there is additional support in the record to allow blanket terminals. *See* Space Norway Comments at 5.

[87] *See* SES/O3B Comments at 10; LeoSat Comments at 4-5.

compliance with EPFD limits.[88] Based on existing systems' demonstrated ability to operate and avoid harmful interference,[89] OneWeb submits that there is no longer any need for NGSO FSS to be designated as "secondary" in the 19.7-20.2 GHz band, provided that the operator can demonstrate its compliance with relevant EPFD limits and operate on an unprotected basis relative to GSO uses of the band.

### B. The 18.8-19.3 And 28.6-29.1 GHz Bands Can Be Utilized By Both GSO And NGSO Operators, Subject To Appropriate Protections.

The Commission proposes to make the 18.8-19.3 and 28.6-29.1 GHz bands, currently allocated to NGSO FSS use on a primary basis,[90] available to GSO FSS operations on either a secondary or co-primary basis.[91] OneWeb believes that a co-primary allocation is workable, provided that both GSO and NGSO operators abide by conditions designed to minimize the likelihood of harmful interference. Although there is currently no sharing mechanism between NGSO and GSO systems in place in these frequency bands, such a mechanism would need to be implemented to permit co-primary allocations. Certain GSO operators suggest that the ITU coordination regime's first-come, first-served basis is sufficient to permit operation of both types of systems without further sharing criteria.[92] OneWeb instead suggests implementing a sharing mechanism consisting of the following steps: (1) deleting the current rule that prevents filing of both NGSO and GSO applications in frequency bands that do not have formal sharing rules; and

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[88] *See, e.g.*, *In re Northrop Grumman Space & Mission Sys. Corp.*, 24 FCC Rcd 2330, 2343 ¶¶ 33-34 (2009); *In re contactMEO Commc'ns, LLC*, 21 FCC Rcd 4035, 4045 ¶ 26 (2006); *see also* NPRM at ¶¶ 4-6.

[89] *See id.*

[90] 47 C.F.R. § 25.202(a); 47 C.F.R. § 2.106, footnote NG165.

[91] NPRM at ¶ 12.

[92] *See, e.g.*, Inmarsat Comments at 5.

(2) adopting appropriate power limits on both NGSO and GSO transmissions to avoid harmful interference between the systems.

First, the Commission should delete Section 25.156(d)(5) of its rules, which states that absent sharing rules between GSO FSS and NGSO FSS, it will not accept applications of one type after it has granted an application for the other type in the same frequency band and that concurrent GSO/NGSO applications will result in a division of spectrum.[93] This provision is unnecessarily restrictive and outdated, as the Commission has already considered overlapping NGSO and GSO applications in bands without established sharing rules.[94] Next, the Commission should adopt appropriate power limits on NGSO and GSO systems in both the 18.8-19.3 and 28.6-29.1 GHz bands. OneWeb is currently in discussions with multiple GSO operators and has determined that EPFD limits on the OneWeb system and e.i.r.p. limits on the GSO earth stations would mutually protect NGSO and GSO FSS constellations and serve all parties' interests in these spectrum bands. Due to the short time between comments and replies in this NPRM, OneWeb has not been able to fully explore this proposal with all GSO operators, but would encourage the Commission not to grant co-primary status to GSO FSS in these bands absent such express power limitations. OneWeb believes that the above proposal represents the best possible compromise to allow unimpeded operations of GSO FSS and NGSO FSS on a co-primary basis in the 18.8-19.3 and 28.6-29.1 GHz frequency bands.

### C. Spectrum that Has Been Designated for, But Infrequently Used by, NGSO MSS Systems for Feeder Links Should Be Opened to NGSO FSS Use.

As the Commission points out, the 19.3-19.4, 19.6-19.7, and 29.3-29.5 GHz bands, although designated for NGSO MSS feeder link use, have not been used by any NGSO MSS

[93] *See* 47 C.F.R. § 25.156(d)(5).

[94] NPRM at ¶ 21 & n.56 (citing instances of the Commission waiving Section 25.156(d)(5) to accommodate both NGSO and GSO applications).

licensee in the United States to date.[95] This spectrum currently lies fallow, and OneWeb agrees with commenters who argue that it should be opened up for use by NGSO FSS systems that are seeking additional spectrum.[96] Also, consideration could be given to allowing NGSO FSS systems to operate in the remaining 19.4-19.6 GHz and 29.1-29.3 GHz bands, subject to coordination with the Iridium system.

OneWeb supports the efficient use of this spectrum, including by allowing operators from various services to use the same spectrum where that can be accomplished without harmful interference. Efficiency also dictates that, to the extent possible, systems should be consistently treated across spectrum bands. To that end, the Commission should allow both NGSO and GSO systems to be co-primary with MSS feeder links in these bands, subject to coordination among the parties and potentially the imposition of EPFD limits consistent with those in the lower adjacent bands.[97] Iridium's existing use of surrounding spectrum for feeder links should be protected from interference by any new entrants, and FSS uses of the spectrum should be on an unprotected, non-interference basis with respect to MSS feeder links.

[95] NPRM at ¶ 7.

[96] *See, e.g.,* Boeing Comments at 6; Intelsat Comments at 2; ViaSat Comments at 7-8.

[97] As OneWeb points out in Section I.B *supra*, the NGSO FSS should be able to select and use either set of $EPFD_{down}$ limits from tables 3G and 4G of the proposed new rules (*see* NPRM at Appendix A). However, if the Commission decides that only one set of EPFD limits are to apply in these new NGSO FSS bands, where they do not apply in the ITU Radio Regulations, then the limits in Table 3G should be used. The band 19.3-19.7 GHz resembles much more the lower part of the Ka-band (17.8-18.6 GHz) than the upper range (19.7-20.2 GHz) due to the presence of terrestrial services which restrict FSS in general to larger terminals, and the fact that the upper 500 MHz band also has an allocation to the MSS which is not present below 19.7 GHz.

## VII. CONCLUSION

OneWeb commends the Commission for initiating this proceeding and the important stakeholders who have added valuable contributions to this record. By adopting the foregoing proposals, OneWeb respectfully submits that the Commission will ensure the continued vitality of innovative, satellite-based services.

Respectfully submitted,

ONEWEB

*/s/ Marc Dupuis*
Marc Dupuis
Policy Director
WorldVu Satellites Limited
1400 Key Boulevard, Suite A1
Arlington, VA 22209

**Of counsel:**

Brian Weimer
Douglas Svor
Ashley Yeager
Sheppard Mullin Richter & Hampton LLP
2099 Pennsylvania Ave NW, Suite 100
Washington, DC 20006
(202) 747-1930